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How Rational versus Intuitive Thinking Styles predict Paranormal Belief.

Natasha Sunter

## How Rational versus Intuitive Thinking Styles predict Paranormal Belief.

**ABSTRACT**

The present study investigated the extent to which thinking style predicted paranormal belief. To achieve this, Belief in Science indexed rational thinking, whilst cognitive-perceptual measures (reality testing, emotion-based reasoning and jumping to conclusions) indexed intuitive thinking. Additionally, relationships between thinking style related variables and specific facets of paranormal belief were explored. Past research has found positive correlations between intuitive thinking styles and belief in the paranormal. In contrast, negative correlations have been observed between rational thinking style and belief in the paranormal (Aarnio and Lindeman, 2005; Pennycook et al., 2012; Irwin and Young, 2002). A convenience sample of 278 participants completed an online questionnaire. Pearson's correlations and a multiple regression analysed the collected data. Consistent with the hypotheses, the results yielded showed a positive relationship between intuitive thinking styles and belief in the paranormal, whilst rational thinking styles were found to negatively correlate with paranormal belief. Generally, correlations across separate facets of paranormal belief were consistent (ghosts, superstition, ESP, PK, astrology and witchcraft) with the exception of religion and aliens. Based on the findings of the study, future research should consider building on the implications and limitations of the present study.

<b>KEY WORDS:</b>	<b>PARANORMAL BELIEF</b>	<b>INTUITIVE</b>	<b>RATIONAL</b>	<b>BELIEF IN SCIENCE</b>	<b>COGNITIVE-PERCEPTUAL</b>
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The purpose of the present study is to look at whether thinking styles predicted paranormal belief (PB) and the extent of the relationship between them, as well as exploring how the relationship varies as a function of the variables.

## **Background of Paranormal Belief**

Advancements in science and technology have been thought to be one of the reasons behind the triumphant nature of rationality over paranormal and superstitious beliefs (Mauss, 1972). Despite this, paranormal beliefs are seemingly widespread in Western culture with more than a third of American's claiming to believe in certain aspects of paranormal beliefs (also known as magical or superstitious beliefs; Tobacyk and Milford, 1983), such as psychic powers, extrasensory perception (ESP) and alien visitations (Rice, 2003). There is a lack of conceptual clarity and a limited amount of definitions that encapsulate paranormal beliefs within scientific literature, with some researchers describing them as limits in an individuals' cognitive processing (Shweder, 1977), ideas founded on ignorance (Padgett and Jorgenson, 1982) and conventionally invalid casual beliefs (Brugger and Graves, 1997), which could be attributable to the multidimensional nature of paranormal beliefs (Tobacyk and Milford, 1983).

Although there is no single consensus as to what constitutes as paranormal belief, it can be referred to a collection of wide-ranging ideas involving psi, superstition and telekinesis (Lindeman and Svedholm, 2012). An underlying definition explains them as beliefs that are beyond the analytical thinking capacity of humans; going against all the laws of nature (Chou and Chang, 2013). Research has been centered around beliefs in paranormal agents such as witches, ghosts and human paranormal abilities for instance, ESP, telepathy or psychokinesis (PK) (Rice, 2003). However, in a great deal of scientific literature, the separate facets that constitute paranormal belief are usually grouped together under one umbrella term of 'paranormal belief'; rather than looking at the correlates between each singular facet and the differing thinking styles.

## **Thinking Styles**

When attempting to explain paranormal beliefs, research has consistently reported a link with cognitive and decision-making biases which may predispose an individual to believe in paranormal phenomena (Irwin, 2009). Several studies have linked the two variables together, with small yet consistent significant positive correlations being noted (Aarnio and Lindeman, 2005; Irwin and Young, 2002). When broadly defined, cognition refers to the mental activities that are associated with the processing of information, including thinking and perception (French and Wilson, 2007). Dual-processing theories have put forward two types of information processing styles (Gold and Gold, 2014; Ross et al., 2016; So et al., 2016; Norris and Epstein, 2011; Pacini and Epstein, 1999). These are: intuitive (also known as experiential) and rational (also known as analytical) thinking styles which operate within different rules (Chou and Chang, 2013). Intuitive thinking styles are rooted in a cognitive processing system that is holistic, rapid and largely preconscious with personal experience being regarded as the main tool in processing information. This contrasts with rational thinking that is much slower, analytical, logical and conscious (Norris and Epstein, 2011; Pacini and Epstein, 1999). Belief in paranormal phenomena is associated with

an over-reliance on intuitive as opposed to rational thinking (Irwin, 2009; Pennycook et al., 2012; Stanovich and West, 1998), with the conclusion being drawn that believers in the paranormal exhibiting a deficit in cognitive processing. This is explained by the 'cognitive deficit hypothesis' (Irwin, 2009) which suggests that individuals who are prone to belief in the paranormal lack the skills and abilities associated with ordinary cognition (van Elk, 2017).

Previous research has found that individuals with an intuitive thinking style are more likely to believe in the paranormal. This sentiment is supported by studies which have demonstrated negative correlations between rational thinking and paranormal beliefs (Aarnio and Lindeman, 2005; Irwin and Young, 2002); thus illustrating the link that exists between the differing thinking styles and belief in the paranormal. Recent research has followed suit with empirical evidence from Lindeman and Aarnio (2006) who found that high intuitive and low rational thinking styles were important predictors of belief in the paranormal; noting that there is a heavy reliance on intuitive thinking within believers of paranormal phenomena. This sentiment is further echoed by Pennycook et al., (2012) who found that individuals who rejected an intuitive style of thinking were the ones who were more likely to reject paranormal beliefs. Pennycook et al., (2012) suggested that the reason behind the decreased levels of paranormal belief in analytically orientated individuals is due to the fact that many paranormal facets such as black magic and mind reading are counterintuitive; meaning that they are incongruent with the naturalistic worldview that some individuals hold (Atran and Norenzayan, 2004).

### **Thinking Styles and Perceptual Measures**

The observable link between the concepts of thinking styles and cognitive-perceptual measures allows rational and intuitive thinking styles to be distinguished between one another. Scales composed of cognitive-perceptual measures have been used in past research (Irwin et al., 2012a, 2013, 2014) such as the Cognitive Biases Questionnaire for Psychosis (CBQp; Peters et al., 2010) and the Belief in Science Questionnaire (BIS; Farias et al., 2013), which allow the discrimination between the two modes of thinking styles. The CBQp highlights deficits in cognitive biases which paranormal believers are observed to have an increased proneness to. This is supported by the cognitive deficit hypothesis (Irwin, 2009), with a higher score in the CBQp representing deficits in cognitive biases, which in turn are linked with an intuitive style of thinking. For instance, deficits in reality testing are said to steer individuals towards an intuitive style and away from a rational style of thinking in the interpretation of paranormal and anomalous events (Dagnall et al., 2015). On the other hand, a higher score on the BIS scale suggests a rational style of thinking, with a greater belief in science often involving the rejection of paranormal and supernatural beliefs (Farias et al., 2013) and therefore a rejection of the intuitive thinking style often paired with belief in the paranormal (Irwin, 2009; Pennycook et al., 2012; Stanovich and West, 1998). This is further supported by Aarnio and Lindeman (2005) who found that scientifically orientated medicine students held one of the lowest levels of belief in the paranormal, as well as students of natural science having lower levels of paranormal beliefs in comparison to less scientifically orientated arts and humanities students (Gray and Mill, 1990; Grimmer and White, 1992; Aarnio and Lindeman, 2005).

## Perceptual Measures and Paranormal Beliefs

Cognitive biases have been observed to be a factor in the formation of delusions (Irwin et al., 2014). Delusions are understood to be one of the principle foundations in the establishment of paranormal beliefs (Irwin et al., 2013). Both cognitive biases and delusions are said to predict the intensity of paranormal beliefs (Irwin et al., 2014). A substantial body of research suggests that believers in the paranormal have many cognitive biases that underlie their beliefs (Irwin et al., 2012b). Believers in the paranormal are able to be understood by the cognitive deficit hypothesis (Irwin, 2009) with deficits in reality testing (RT), jumping to conclusions (JTC) and emotion-based reasoning (EBR) being commonly observed (Irwin et al., 2012b; Dagnall et al., 2015; Blagrove et al., 2006; Brugger and Graves, 1997; Irwin et al., 2012a; Irwin et al., 2014; Sappington, 1990; Drinkwater et al., 2018).

Delusions are said to surface when inferences that are made do not undergo stringent reality testing (Langdon and Coltheart, 2000). Support for this comes from Drinkwater et al., (2012) with moderate to strong correlations being observed between RT deficits and paranormal belief. Paranormal belief scores are observed to predict RT deficits (Irwin, 2003). This is further reinforced by research that has found a positive relationship between paranormal beliefs and a proneness to RT deficits (Irwin et al., 2012b; Dagnall et al., 2015), thus highlighting the important role that deficits in RT has in the formation and maintenance of paranormal beliefs (Irwin, 2003; 2004). Per contra, Irwin et al., (2012b) found EBR to be the greatest predictor of paranormal belief, but in later work found that RT was the greatest predictor of paranormal belief with EBR yielding a much smaller correlation (Irwin et al., 2013); thus creating confusion around the relationship between RT and belief in the paranormal.

Another cognitive bias said to be key in the formation of delusions is jumping to conclusions, which refers to the tendency to create an assumption on a limited amount of information (Irwin et al., 2014). Reinforced by empirical evidence, a relationship between a proneness to JTC and traditional paranormal beliefs has been observed (Blagrove et al., 2006; Brugger and Graves, 1997; Irwin et al., 2012a; Irwin et al., 2014), especially in regards to the concepts of religion and witchcraft (Irwin et al., 2012a; Irwin et al., 2014). This finding is mirrored by Dagnall et al., (2014) who noted that JTC is found to be associated with paranormal belief. However, large amounts of scientific research fail to focus solely on the relationship between JTC and paranormal belief as a majority of the research often explores how JTC and delusions are linked instead. In spite of this, the relationship between JTC and belief in the paranormal is difficult to fully understand. Irwin et al., (2014) also suggests that paranormal beliefs may not be linked with JTC but instead are linked more specifically to an individuals' awareness to make impulsive decisions. Irwin et al., (2014) proposes that instead of considering implicit cognitive styles as being a key characteristic in paranormal belief, a consciously affected attitude should instead be considered. This is because an individual may rather go with their gut feeling which in this context would be paranormal belief, than become bogged down in rational analyses that are tedious in nature (Irwin et al., 2014; Irwin and Young, 2002).

Emotion-based reasoning (EBR) is a cognitive bias that refers to the tendency to choose inferences that are not of a rational nature but instead are emotionally appealing and is an observed factor thought to predict the intensity of paranormal belief (Irwin et al., 2012b). Earlier research from Sappington (1990) found that participants with higher EBR were more likely to have interpreted phenomena as paranormal. This is reinforced by more recent empirical research from Irwin et al., (2012b) who found the biggest predictor of belief in the paranormal to be EBR, noting that the general population, excluding those who are objectively orientated, hold paranormal beliefs because they are emotionally appealing instead of their rationality. This sentiment is also echoed by recent work from Drinkwater et al., (2018) who demonstrated a positive correlation between EBR and belief in the paranormal in a study of 248 participants. However, despite the large amount of research supporting the relationship between EBR and paranormal belief, Irwin et al., (2012b) notes that the effect sizes in his study are not large by any means and so suggests that the role of cognitive deficits in the formation of paranormal beliefs should not be overemphasised. Irwin et al., (2012b) also goes on to state that despite the considerable role that EBR plays in paranormal belief, the roles of other types of reasoning should not be overlooked.

Belief in science is characterised by a rational thinking style (Aarnio and Lindeman, 2007), which largely contrasts the intuitive thinking style that is associated with paranormal belief. According to many large scale surveys, it is thought that around 80% of the adult population hold a belief in and trust in science, partially due to the contribution that science has towards the quality of life and the economy (Irwin et al., 2016). It has been noted that attitudes towards science are linked to paranormal belief in the general population with a satisfactory body of research establishing a negative correlation between the two variables (Morier and Keeports, 1994; Aarnio and Lindeman, 2005). This can be understood through the view that supernatural (paranormal) beliefs and science are opposing ideologies (Dawkins, 2006). Believers in paranormal phenomena have been found to disregard scientific values by adopting a more intuitive thinking style that accepts ideas because of the emotional appeal they hold, rather than scrutinising the ideas and considering alternative views (Irwin et al., 2016). Despite this being said, paranormal belief and science have been suggested to have the ability to coexist in the mind (Rosengren and Gutiérrez, 2011), disputing the findings put forward by the research discussed earlier.

## **Rationale, Aims and Hypotheses**

The rationale behind the present study is driven by a lack of research surrounding the relationship between thinking styles and specific facets of paranormal belief. Lindeman and Aarnio (2006) suggest that different paranormal beliefs may have different correlates with rational and intuitive thinking styles, thus providing a framework for the present study to build on. Furthermore, a lot of the literature surrounding JTC is discussed in regard to delusions and schizophrenia, not in regards to paranormal belief. Although delusions are thought to be a foundation for the formation of paranormal beliefs (Irwin et al., 2013), a substantial body of scientific literature does not exist that links paranormal belief and delusions together with thinking styles, making it unclear of the relationship that delusions have with paranormal belief. This makes existing literature difficult to apply within the context of

the present study due to this lack of clarification, thus providing further ground for the present study to take place.

The current study therefore aims to investigate the relationship between thinking styles (rational versus intuitive) and paranormal belief, as well as looking at the extent of the relationship held. The study then aims to go into greater specificity by looking at the relationship between the individual facets of paranormal beliefs with thinking styles. Past research has found a positive relationship between thinking styles and paranormal beliefs and thus it is hypothesized that in the present study there will be a positive relationship between paranormal belief and intuitive thinking styles as measured by the cognitive-perceptual measures. In contrast, a negative correlation will be found between paranormal belief and rational thinking styles as measured by the BIS scale. Correlations between thinking style and separate facets of paranormal belief are also expected to be observed.

## **Methodology**

### **Design**

The current study adopted a non-experimental correlational design to investigate the relationships between thinking styles and paranormal beliefs. The predictor variables were “reality testing”, “emotion-based reasoning”, “jumping to conclusions” and “belief in science.” The criterion variable was “paranormal belief.”

### **Participants**

Two hundred and seventy-eight participants took part in this research project. There were 63 males with a mean age of 28.10 years ( $SD = 12.16$ ), ranging between 18 and 57 years old; and 215 females with a mean age of 25.57 years ( $SD = 10.77$ ), ranging between 18 and 64 years. The overall mean age of the sample was 26.14 years ( $SD = 11.13$ ), ranging between 18 and 64 years old.

Participants were randomly recruited through convenience sampling, allowing anyone over age 18 to take part in the study as it did not require the study of a specific demographic. Additionally, a snowball sampling technique was used in which participants recruited through opportunity sampling were encouraged to pass the questionnaire on to family and friends. In regards to the sample size, the minimum number of participants as recommended by Cohen (1992) is 67, whilst Brace et al., (1996) recommended a minimum of 100 participants when carrying out a multiple regression; thus the sample size is more than ample.

### **Data collection materials**

Multiple scales were used in order to investigate predictor variables which were then combined to create one questionnaire battery (see appendix 2). Questions that measured the demographic background of participants such as age and gender were also included. Details of each of the measures included in the questionnaire are listed below:

**The Cognitive Biases Questionnaire for Psychosis (CBQp; Peters et al., 2010)**



The CBQp consists of thirty statements that cover two themes of 'anomalous perception' and 'threatening events.' Each group of statements covers five different cognitive biases, these are: *intentionalising*; *catastrophising*, *dichotomous thinking*; *jumping to conclusions* and *emotion-based reasoning*. The items are rated on a three-point scale and consist of statements such as 'imagine you applied for a job and did not get it.' Participants indicated their response on what they're most likely to think out of the three answers (A, B or C), which have a correlating score that measures the extent to which their response represents a certain cognitive bias. For the purpose of this study, only twelve of the thirty statements in the CBQp were used, six of these measured jumping to conclusions and the other six measured emotion-based reasoning. Internal reliability for the CBQp was good ( $\alpha = .89$ ; Peters et al., 2010).

#### **Inventory of Personality Organization (IPO-RT; Lezenweger et al., 2001)**

The Reality Testing subscale of the IPO was the chosen scale to measure reality testing. The IPO-RT is made up of statements such as 'When I'm nervous or confused, it seems like things in the outside world don't make sense either' and 'I have seen things that do not exist in reality.' Participants rated each item on a 5-point Likert scale (1 = never true to 5 = always true) to indicate the extent to which they agreed with the statement. Internal consistency of the IPO-RT was found to be excellent ( $\alpha = .92$ ; Drinkwater et al., 2012).

#### **The Belief in Science Questionnaire (BIS; Farias et al., 2013)**

The BIS Questionnaire is a 10-item scale that comprises of items addressing individual's ideas around science. The BIS is made up of items such as 'science is the most valuable part of human culture' and 'all the tasks that human beings face are soluble by science.' Participants rated each item on a 6-point Likert scale (1= strongly disagree to 6 = strongly agree) to show how much they agreed with each statement. Internal reliability for this scale was good ( $\alpha = .86$ ; Farias et al., 2013).

#### **Manchester Metropolitan University New (MMU-N)**

The MMU-N is a 64-item scale which is compiled of 8 paranormal facets (hauntings, superstitions, religion, ESP, PK, astrology, witchcraft and alien visitation) extracted by Dagnall et al., (2010a, 2010b). The MMU-N is made up of items such as 'there is a devil' and 'there are actual cases of witchcraft' in which the participant marks their response on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). The MMU-N possess a good to excellent external reliability (Dagnall et al., 2010a).

#### **Procedure**

An information sheet and a consent form were read by the participant prior to completion of the online questionnaire. Once consent was obtained, the participant was asked to complete the online questionnaire composed of the above scales and were asked to be as open and honest with their answers as possible, as well as not dwelling on one single question for too long a period. Upon completion, participants were then thanked and debriefed and then asked to create a unique personal code that makes their data set identifiable by the researcher should they want to withdraw their data from the study prior to the commencement of data analysis. Once the required amount of responses was reached, the data was entered into a spreadsheet and then transferred over to SPSS to enable the researcher to conduct the data analyses.

## Ethical considerations

The ethical considerations for this research project were in line with the British Psychological Society's (BPS) ethical guidelines (BPS, 2009; see appendix 1). The study was seen unlikely to have a negative affect on participants well-being or health, partly due to its non-invasive nature. Prior to participation, consenting participants were made aware of the aims of the study and reminded of their right to withdraw at any point. Upon completion of the questionnaire, participants were debriefed and given the opportunity to create a unique code to enable them to withdraw at a later point before data analysis commenced. Participants were also provided with contact details for the researcher and the research supervisor should they have any questions regarding the study. Information about the participants was stored on a password protected computer as well as the details being kept anonymous and confidential throughout the data handling process.

## Results

### Descriptive statistics and reliability analysis

Scale internal reliability was conducted prior to the analyses and descriptive statistics were produced accordingly (see Table 1).

Table 1. Cognitive-Perceptual, Belief in Science and Paranormal Belief Measures Descriptives

	<i>M</i>	<i>SD</i>	Min	Max	$\alpha$
<b>Cognitive-Perceptual</b>					
Reality Testing	45.39	15.61	20.00	100.00	.92
JTC	10.48	2.15	7.00	17.00	.55
EBR	8.01	2.19	6.00	18.00	.68
<b>Belief in Science</b>	39.84	11.81	10.00	60.00	.92
<b>Paranormal Belief</b>	211.84	72.88	64.00	430.00	
Hauntings	30.76	14.80	8.00	56.00	.97
Superstition	30.55	10.75	8.00	56.00	.82
Religion	30.14	12.85	8.00	56.00	.90
ESP	31.56	11.82	8.00	56.00	.92
Psychokinesis	19.04	9.82	8.00	55.00	.91
Astrology	22.98	11.56	8.00	56.00	.91
Witchcraft	24.92	12.78	8.00	56.00	.93
Aliens	21.90	13.80	8.00	56.00	.97

Internal consistencies for most of the cognitive-perceptual measures were ideal. 'Reality testing' showed an excellent reliability ( $\alpha = .92$ ), whilst 'emotion based reasoning' had a questionable internal consistency of  $\alpha = .68$ . The only cognitive-perceptual measure that did not have an ideal internal consistency was the 'jumping to conclusions' measure which had poor reliability ( $\alpha = .55$ ). The internal consistency for the belief in science scale was found to be excellent ( $\alpha = .92$ ). Good internal reliability was found for the 'superstition' measure ( $\alpha = .87$ ) of the MMU-N scale and excellent reliability for the other 7 measures of MMU-N scale was found, ranging between  $\alpha = .90$  and .97.

### Correlations between Cognitive-Perceptual measures, Belief in Science and Paranormal Belief

Pearson's correlations were computed for the paranormal belief, cognitive-perceptual measures and belief in science (see Table 2).

Table 2. Paranormal Belief, Cognitive-Perceptual Measures and Belief in Science Inter-Scale Correlations

	1	2	3	4	5
1. RT					
2. JTC	.42**				
3. EBR	.51**	.53**			
4. BIS	-.17**	-.19**	-.30**		
5. PB	.46**	.34**	.44**	-.42**	

\*\* Correlation is significant at the 0.01 level (1-tailed).

Significant positive correlations are observable between each of the cognitive perceptual measures (RT, JTC and EBR) as well as with PB. A positive correlation can be seen between RT and JTC,  $r(276) = .42, p < .001$ . Positive correlations can also be seen between EBR and RT,  $r(276) = .51, p < .001$ , as well as between PB and RT,  $r(276) = .46, p < .001$ . Furthermore, both EBR ( $r(276) = .53, p < .001$ ) and PB ( $r(276) = .34, p < .001$ ) positively correlated with JTC.

PB also was found to positively correlate with EBR,  $r(276) = .44, p < .001$ . BIS negatively correlated with all measures: negatively correlating with RT ( $r(276) = -.17, p < .001$ ); JTC ( $r(276) = -.19, p < .001$ ); EBR ( $r(276) = -.30, p < .001$ ) and PB ( $r(276) = -.42, p < .001$ ).

### Relationships between Individual Facets of Paranormal Belief, Cognitive-Perceptual measures and Belief in Science

Pearson's correlations were computed for facets of PB, cognitive-perceptual measures and BIS (see Table 3).

Table 3. Relations between facets of paranormal belief, cognitive-perceptual factors and belief in science

	Cognitive-Perceptual			BIS
	RT	JTC	EBR	
Ghosts	.37**	.27**	.36**	-.31**
Superstition	.26**	.25**	.23**	-.13*
Religion	.23**	.21**	.28**	-.57**
ESP	.41**	.22**	.38**	-.35**
PK	.46**	.20**	.34**	-.34**
Astrology	.42**	.34**	.46**	-.31**
Witchcraft	.36**	.32**	.40**	-.44**
Aliens	.27**	.21**	.19**	-.06

\*\* Correlation is significant at the 0.01 level (1-tailed); \* Correlation is significant at the 0.05 level (1-tailed).

Belief in ghosts positively correlated with RT ( $r(276) = .37, p < .001$ ); JTC ( $r(276) = .27, p < .001$ ) and EBR ( $r(276) = .36, p < .001$ ), but negatively correlated with BIS,  $r(276) = -.31, p < .001$ . Furthermore, ESP positively correlated with all cognitive-perceptual measures: RT ( $r(276) = .41, p < .001$ ); JTC ( $r(276) = .22, p < .001$ ) and EBR ( $r(276) = .38, p < .001$ ), whilst negatively correlating with BIS,  $r(276) = -.57, p < .001$ .

PK correlations reported similar positive correlations with RT ( $r(276) = .46, p < .001$ ); JTC ( $r(276) = .20, p < .001$ ); and EBR ( $r(276) = .34, p < .001$ ), whilst negatively correlating with BIS,  $r(276) = -.34, p < .001$ . Significant positive correlations were also observed between astrology and cognitive-perceptual measures: RT ( $r(276) = .42, p < .001$ ); JTC ( $r(276) = .34, p < .001$ ); and EBR ( $r(276) = .46, p < .001$ ) and between witchcraft and cognitive-perceptual measures: RT ( $r(276) = .36, p < .001$ ); JTC ( $r(276) = .32, p < .001$ ); and EBR,  $r(276) = .40, p < .001$ . Astrology negatively correlated with BIS,  $r(276) = -.31, p < .001$ , as did witchcraft and BIS,  $r(276) = -.44, p < .001$ .

Differentiating from the above paranormal facets, superstition was observed to only hold weak positive correlations with all of the cognitive-perceptual measures: RT ( $r(276) = .26, p < .001$ ); JTC ( $r(276) = .25, p < .001$ ) and EBR ( $r(276) = .23, p < .001$ ), whilst showing a very weak negative correlation with BIS,  $r(276) = -.13, p = 0.05$ . Weak positive correlations were found between religion and cognitive-perceptual measures: RT ( $r(276) = .23, p < .001$ ); JTC ( $r(276) = .21, p < .001$ ); and EBR ( $r(276) = .28, p < .001$ ) and had a moderate negative correlation with BIS,  $r(276) = -.57, p < .001$ . As expected, aliens showed the weakest positive correlations with cognitive-perceptual measures: the correlations with RT,  $r(276) = .27, p < .001$ , and JTC,  $r(276) = .21, p < .001$  were weak and the correlation with EBR was very weak,  $r(276) = .19, p < .001$ . No significant correlation was observed between aliens and BIS.

### Factors predicting Paranormal Belief

A multiple regression analysis was performed in order to see the extent to which RT, JTC, EBR and BIS were predictors of PB amongst the sample. The tests for collinearity found that the data set met the assumption of no multicollinearity as all variables were within tolerance. Through use of the 'enter' method a significant model was found,  $F(4,273) = 39.33, p < .001$  (see table 4).

Table 4. Summary of regression analysis for predicting paranormal belief scores

Variable	<i>B</i>	<i>SE B</i> (std. Error)	$\beta$ (beta score)	<i>t</i>	Sig.
Constant	157.45	24.79		6.35	.000
RT	1.40	.27	.30**	5.25	.000
JTC	2.41	1.98	.07	1.22	.224
EBR	5.26	2.09	.16*	2.52	.012
BIS	-1.93	-.31	-.31**	-6.17	.000
$R^2 = .36$					

\* indicates  $p < .05$ ; \*\* indicates  $p < .001$

A strong relationship was observed ( $R = .61$ ) with the model able to explain approximately 36.6% ( $R^2_{adj} = 35.6\%$ ) of the variance in the paranormal belief scores. The strongest predictor of paranormal belief was found to be RT,  $\beta = .30$ ,  $t(273) = 5.26$ ,  $p < .001$ . Additionally, EBR was a predictor of paranormal belief,  $\beta = .16$ ,  $t(273) = 2.52$ ,  $p = .012$ . Belief in Science was a significant negative predictor of paranormal belief,  $\beta = -.31$ ,  $t(273) = -6.17$ ,  $p < .001$ . The contributions of the predictor variables to paranormal beliefs are detailed in Table 4.

Overall, the results indicate that the most significant predictor of paranormal beliefs was reality testing. Emotion-based reasoning was also a significant predictor of paranormal belief. Belief in Science negatively predicted paranormal belief whilst jumping to conclusions was found to be a non-significant predictor.

## Discussion

The present study examined the relationship between thinking styles and paranormal belief, before going into further specificity and looking at how thinking styles correlate with separate facets of paranormal beliefs. In relation to the hypotheses, the results of the present study demonstrated support for the relationship between thinking styles and paranormal belief. Further regression analyses illustrated a positive correlation between intuitive thinking styles and paranormal belief, meaning the greater belief in the paranormal participants held, the more likely they were to score higher on the cognitive-perceptual measures. These findings reaffirm findings from past research that have also highlighted a positive relationship between intuitive thinking styles and a greater belief in the paranormal (Lindeman and Aarnio, 2006; Pennycook et al., 2012; Irwin, 2009; Stanovich and West, 1998).

Of all the cognitive-perceptual measures, RT was revealed to be the strongest predictor in paranormal belief and as predicted, paranormal belief positively correlated with the other cognitive-perceptual measures: EBR and JTC, but to a lesser extent than RT. Further to this, RT being the best predictor of paranormal beliefs mirrors findings from Irwin (2003, 2004) who similarly to the present study noted the important role that RT deficits hold in the formation of paranormal beliefs. Despite the positive correlation observed between RT and paranormal belief, the strength of the effect size ( $r = .46$ ) only demonstrates a moderate positive correlation between the variables (Evans, 1996), and so forth the observed relationship is not overly compelling. The same can be said with the positive correlations between JTC ( $r = .34$ ) and EBR ( $r = .44$ ) with paranormal belief, as the strength of the relationships between the variables ranges between weak and moderate (Evans, 1996).

Also as predicted, BIS negatively correlated with paranormal belief and so this finding is coherent with past research that has also observed a negative relationship between the two variables (Morier and Keeports, 1994; Aarnio and Lindeman, 2005). Furthermore, BIS was found to negatively correlate with the cognitive-perceptual measures; RT, EBR and JTC but the correlations observed ranged between weak to very weak (Evans, 1996). Likewise, the relationship between BIS and paranormal belief was that of a moderate negative correlation and so again the strength of this relationship is questionable and is not overly compelling.

Fairly similar significant positive correlations were observed between all of the cognitive-perceptual measures and the individual facets of paranormal belief with the exception of religion and aliens; which despite being significant held weak correlations with measures of cognitive-perception. RT was the greatest predictor of all the paranormal facets, excluding religion, out of all of the cognitive-perceptual measures. In contrast, BIS held consistent negative correlations across the separate facets of paranormal belief as predicted. The only non-significant relationship observed in the entire study was the correlation between BIS and belief in aliens.

When looking at the separate facets of paranormal belief, the highest correlation was held between PK and RT as well as between astrology and EBR ( $r = .46$ ). The present study found conforming evidence for the idea that science and religion cannot coexist in an individual's mind as the strongest negative correlation was observed between RT and BIS ( $r = -.57$ ), thus lending support to the findings from Rosengren and Gutiérrez, (2011). Only one non-significant correlation can be observed in the present study and so there is a substantial amount of support for the study's hypotheses. Nonetheless, the lack of strength in the correlations observed between the cognitive-perceptual measures and BIS with the individual facets of paranormal belief should be considered as they range from very weak to moderate (Evans, 1996), ergo the lack of strength between the relationships needs to be investigated in greater depth before drawing any firm conclusions about the extent to which thinking styles predict paranormal belief and its facets.

The present study has been successfully able to demonstrate that there is a relationship between thinking styles and paranormal belief, but the study does indeed have limitations that need to be taken into consideration. As discussed earlier, there is a lack of strength in regards to the relationships between the variables, therefore meaning we cannot draw solid conclusions in regards to how thinking styles predict paranormal belief. The measures used to measure thinking style, (CBQp and BIS) can be criticised as they are proxy measures. This means that these scales were not initially created to measure thinking styles and so we can only infer that the responses participants give are representative of either an intuitive or rational thinking style; firm conclusions cannot be drawn. The measures used are also considered to be multi-dimensional and so may measure some concepts, for example, certain facets of paranormal belief more than they measure some of the other facets.

The present study made use of an online battery of questionnaires in which the participant fills in themselves. The self-report data yielded may contain social desirability bias that could have affected participants' responses due to them answering in a way that they think the researcher and others would view in a favourable light. This poses a problem as a self-report measure may not present us with a true insight into an individuals' thoughts and feelings in regard to their belief in the paranormal and in turn will have affected the results. Furthermore, the battery of questionnaires may have affected the data due to its length nature. The first scale in the questionnaire, the MMU-N scale, consisted of 64-items and was then followed subsequently by the other three scales. This could have led to participant fatigue or a lack of interest in the study. Participant fatigue can be problematic as they are able to become unengaged from the survey which could lead to participants choosing random answers or engaging in straight-line responding. This is where participants choose

multiple answers down the same column on the survey; especially at later stages in survey participation.

In order to recruit participants to take part in the present study, convenience sampling was the recruitment method of choice. Although this method allows the researcher to gather a large number of participants at once due to the fact it is not used to study a specific demographic, it can be problematic as it can be criticised for sampling bias. This is where the sample is not representative of the entire population as the researcher has not been able to intentionally recruit participants from different cultures, countries, ethnicities and other individual differences that may have an affect on the results. Although it is possible that this recruitment method may have gathered participants from different backgrounds, the researcher cannot be sure of this due to the anonymity that participants are entitled to. This leads to a problem in making generalisations and inferences about the results in regards to the entire population, thus resulting in a low external validity. The gender ratio of the participants in this study is also problematic in regards to generalisation of the results to the male population due to the overwhelming amount of female (N = 215) to male (N = 63) participants. This too can be said about the mean age of participants (26.14 years) with this meaning the results may be difficult to generalise to an older generation as they are seemingly under-represented in this sample.

The findings from the present study provide us with an understanding of how thinking styles affect belief in the paranormal and why some individuals are more prone to holding such beliefs. This has an implication for further research to be carried out as it highlights the need for a further understanding of the relationships that are held; especially in regards to the individual facets of paranormal belief. The findings from this research also implicate how we can apply scientific knowledge to paranormal belief, a topic that upon first glance seems to be the polar opposite to scientific knowledge and its principles. Not only this, but research within this area is able to broaden our worldview and creates ground for further scientific endeavours to be carried out in an area of psychology which is less well researched.

Further research should consider looking further into the relationships between the separate facets of paranormal belief and thinking styles due to the large gap that exists in this area of psychological research. Copious amounts of scientific research tend to focus heavily on Western cultures and their beliefs in the paranormal whilst failing to acknowledge that other cultures may demonstrate completely different beliefs. To overcome this, a larger, more representative sample should be obtained in future studies, ensuring recruitment of many participants from differing backgrounds, as although the present study had an adequate sample, it lacked representativeness in regards to culture, age and other individual differences that may influence the outcome of the results in a study. By doing this, generalisations and inferences about the findings can be more easily made.

To conclude, the findings from the present study have contributed to the existing literature surrounding this research area by using previous findings as a framework before expanding on these to obtain a greater understanding about the relationship that is observed between thinking styles and paranormal belief. Expansion on earlier research has been achieved by the present study going into greater specificity and looking at the relationships between the individual facets of paranormal

belief and then how these then correlate with thinking styles. No previous literature has seemed to focus on this specific of a link and so much more research is needed within the topic area in order to close the gap in the existing literature and allow clearer comprehension of this association in a more thorough manner.



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